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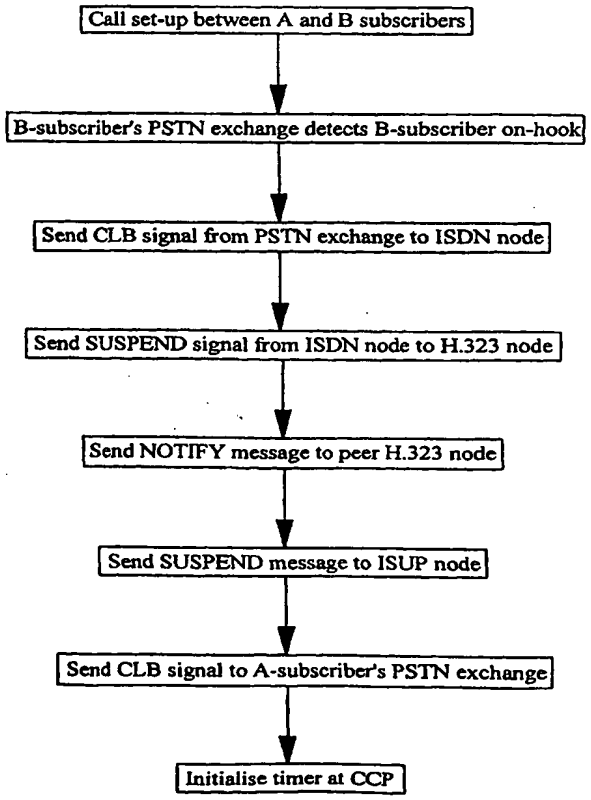
(54) Title: SIGNALLING IN A TELECOMMUNICATIONS SYSTEM

(57) Abstract

A method of passing a Clear Back (CLB) and/or REANSWER message from a PSTN access point (2) to a call charging point (10) via an H.323 network (7) which uses a DSS1 based signalling protocol. The method comprising defining call clearback and reanswer parameters and including one or other of the parameters as a Notification Indicator information element of a NOTIFY message of the DSS1 based protocol, for transmission over said network (7), in response to generation of a Clear Back (CLB) or REANSWER message at the PSTN access point (2).



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SIGNALLING IN A TELECOMMUNICATIONS SYSTEM

Field of the Invention

The present invention relates to signalling in a telecommunications system and in particular, though not necessarily, to the transmission of signalling data over an H.323 network.

Background to the Invention

Traditional telecommunications networks are known as Public Switched Telephone Networks (PSTNs) and use a variety of transmission and signalling protocols to communicate between subscribers and network nodes. For example, in the United Kingdom inter-exchange signalling is conveyed using the NUP protocol whilst certain other countries use the TUP-protocol.

Recently, a new type of telecommunications network has been introduced and is known as the Integrated Services Digital Network (ISDN). ISDN may be implemented between network nodes and between subscribers and their local exchanges. In the link between a subscriber and that subscriber's local exchange (the subscriber "access point"), ISDN uses a signalling protocol known as Digital Subscriber Signalling System No.1 (DSS1), whilst a further protocol known as ISDN User Part (ISUP) is used to convey signalling data within the network, i.e. inter-node signalling. In a typical scenario, a call connection may pass through one or more PSTN parts and one or more ISDN parts.

In the current competitive telecommunications market, it is vital for a telecom operator to provide a wide and varied range of basic, supplementary, and added value services, as well as to minimise the cost of services to the end users. As such, existing telecommunications networks, and in particular ISUP, have evolved to provide for the transfer of many messages and parameters relating to such services between the various nodes (or signalling points) of the networks.

Conventional telecommunication networks are designed such that the calling party (A-subscriber, A-user, A-party, A-number, A-address etc.) is normally responsible and therefore charged for the cost of a call and/or connection time, while the called party (B-subscriber, B-user, B-party, B-number, B-address etc.) does not have to pay anything for the received calls and/or the connection time of the received call. The charging may be arranged to occur beforehand (so called pre-paid calling arrangements) or afterwards (e.g. by means of a telephone bill).

Telephone calls are usually charged according to their duration. Other charging criteria may be used by network operators such as the distance between the subscribers, etc. So as to enable reliable charging, an ongoing call is monitored and required charging information sent to a Call Charging Point (CCP) of the calling party which may be implemented for example in the A-subscriber's local exchange. So-called pulse metering and toll-ticketing (TT) are referred to herein

as possibilities for implementing the charging. At the end of a call, i.e. when the call is released, the call charging point will be notified accordingly and the call charge accumulation will be terminated.

Conventional telecommunications networks for conveying voice and other user information have in general relied upon dedicated telecommunications network infrastructure and transmission protocols (i.e. PSTN and ISDN). However, with the recent explosive growth in digital data transmission, driven in particular by the use of intranets and the World Wide Web, there has been a move towards the use of more generic infrastructure and transmission protocols in the telecommunications industry. This move is driven primarily by the desire for interoperability between telecommunications networks and other data networks, and secondarily by the cost advantages which general data network systems offer over conventional telecommunications systems.

In 1996, the International Telecommunications Union (ITU) defined a standard for the transmission of multimedia data over Local Area Networks (LANs) as well as "internetworks" composed of multiple interconnected LANs. This standard is known as H.323, whilst the 1998 revision is known as H.323 Version 2. A fundamental and essential component of H.323 is the provision for the transmission of digitised and compressed voice data. However, H.323 also makes optional provision for the transmission of video and other data forms. H.323 has already been implemented in multimedia products such as Microsoft Netmeeting™. There currently exists a demand

to introduce H.323 as a means of communicating between signalling points of a telecommunications network. This may lead to a situation where H.323 must co-exist with ISDN and PSTN. A typical scenario might involve a calling party and a called part both being connected to respective PSTN access networks (using for example NUP or TUP), with part of the intermediate signalling link being provided by an ISDN network (using ISUP) and a part being provided by an H.323 network.

H.323 makes mandatory the use of the ITU standard H.225 which is based on DSS1 (sometimes referred to as Q.931) signalling for the negotiation of a call set-up between two H.323 nodes, to establish a channel therebetween over which the terminals may send user and signalling data. In addition, DSS1 is mandatory for certain call maintenance and termination functions.

Summary of the Present Invention

The inventors of the present invention have discovered that the existing DSS1 based signalling protocol employed by H.323 is not able to accommodate certain signalling information which may be generated within a telecommunications system and for which provision is made in the existing PSTN and ISUP standards. It has further been recognised that this incompatibility hinders the introduction of H.323 in telecommunications networks.

In current PSTN networks (where the connection between the calling party and called party is purely PSTN) a

calling party (A-subscriber) terminates a call by hanging-up his telephone, i.e. by going "on-hook". This results in a Clear-Forward Signal (CFS) being sent from the A-subscriber's local PSTN exchange to the appropriate Call Charging Point (CCP). The call is terminated immediately and charge accumulation stopped. The mechanism for terminating a call in response to an on-hook by a called party (B-subscriber) is however somewhat different. On-hook by the B-subscriber is detected at his local PSTN exchange. Detection of a B-subscriber on-hook is signalled back to the CCP by sending a Clear Back (CLB) signal from the B-subsciber's local exchange to the CCP.

Receipt of a CLB signal at the CCP does not immediately result in the termination of the call. Rather, receipt causes the initiation of a timer at the CCP. In the event that the B-subscriber goes "off-hook" before the expiry of the timer (typically the timer runs for 90 seconds or thereabouts), the B-subscriber's local exchange sends an REANSWER signal to the CCP. This causes the cancellation of the timer at the CCP. If no REANSWER signal is received by the CCP before expiry of the timer, the CCP causes the connection to be cleared and charge accumulation is stopped. This facility is provided to allow, for example, the B-subscriber to on-hook on one extension and to subsequently off-hook on another extension without terminating the call.

Where an intervening portion of the signalling connection between the A and B subscribers is provided by ISUP signalling, the CLB and REANSWER signals are

carried by appropriate ISUP messages. In particular, the CLB signal is carried by an ISUP SUSPEND message (with an indication that the suspension request is network initiated) whilst the REANSWER signal is carried by an ISUP RESUME message (again with an indication that the suspension request is network initiated).

The inventors of the present invention have noted however, that whilst ISUP caters for a B-subscriber timer initiation and reanswer as described above, H.323 (H.225) does not. This means that in telecommunications networks which rely upon H.323 for carrying signalling information over at least part of a connection, the B-subscriber cannot suspend a call in the expected manner.

It is an object of the present invention to overcome or at least mitigate the above noted disadvantages of existing H.323 (H.225) signalling systems.

It is a second object of the present invention to provide an improved solution for call charging procedures in telecommunication networks using an access protocol or an access based protocol for signalling.

It is a third object of the present invention to ease network architecture planning without the need to redesign the basics of the present protocol signalling, especially having regard to IP networks and other router based networks.

It is a fourth object of the present invention to avoid the need to relocate call charging points of a network.

According to a first aspect of the present invention there is provided a method of communicating signalling information between a pair of telecommunication networks employing ISUP or PSTN signalling, via a data network, the method comprising using the H.323 protocol to communicate over the data network where signalling data is carried by a DSS1 based protocol extended to provide for the transmission of ISUP/PSTN information which cannot be carried by DSS1.

The term "extended" is used here to define that the DSS1 based protocol is changed to accommodate new messages and/or message fields. ISUP/PSTN information not already catered for in DSS1 is not merely transmitted over the data network by encapsulating them within "carrier" messages.

In one embodiment of the present invention, the method is used for initiating a timer procedure at a call charging point of one of the ISUP/PSTN networks. The method comprises the further steps of detecting an on-hook state of a called party, and signalling a timer initiation request from the called party access point to the call charging point by means of an extension to the DSS1 based protocol. A subsequent off-hook state of the called party may result in signalling a REANSWER indication to the call charging point whereupon the timer is cancelled.

Preferably, the on-hook state is detected at the access point of the called party, and the timer initiation

request is signalled by means of the extension of the DSS1 based protocol from the access point of the called party to the call charging point, the call charging point of the calling party being integrated or linked to the access point of the calling party.

More preferably, the timer initiation signal is a clear back signal (CLB) which causes an immediate initialisation of the call suspension timer which upon expiry will clear the call.

The DSS1 based protocol may be extended to include an extension for signalling REANSWER signal (RES) to the charging point of the calling party for cancelling the call suspension timer.

Preferably, said data network which uses H.323 is a packet switched data network. More preferably, the network is an IP network. This network may be a LAN, an internetwork, the Internet, or a combination of two or more of these. In these cases, the H.323 protocol stack is provided over an IP protocol stack.

According to a second aspect of the present invention there is provided a method of passing a Clear Back (CLB) and/or REANSWER message from a PSTN access point to a call charging point via a network which uses a DSS1 based signalling protocol, the method comprising defining call clearback and reanswer parameters and including one or other of the parameters as a Notification Indicator information element of a NOTIFY message of the DSS1 based protocol, for transmission

over said network, in response to generation of a Clear Back or REANSWER message at the PSTN access point.

Preferably, the Notification Indicator information element is available for transmission from a called party access point to the charging centre or calling party access point in response to an off-hook operation at the called party, wherein the element conveys an off-hook notification value. Preferably, in response to an on-hook operation by the called party, the Notification Indicator information element conveys an on-hook notification value.

Preferably, the method comprises polling the called party from the called party access point to detect an on-hook operation.

Preferably, said DSS1 based signalling protocol is used by an H.323 network to establish and control connections over said network.

According to a third aspect of the present invention there is provided apparatus for communicating signalling data between a pair of telecommunication networks employing ISUP or PSTN signalling, via a data network, the apparatus comprising means for using H.323 protocol to communicate over the data network where signalling data is carried by a DSS1 based protocol extended to provide for the transmission of ISUP/PSTN messages which cannot be carried by DSS1.

According to a fourth aspect of the present invention there is provided a method of communicating signalling data between a pair of telecommunication networks employing ISUP or PSTN signalling, via a data network, the method comprising using H.323 protocol to communicate over the data network, wherein signalling data is carried by a Q.76x based protocol substituted in the H.323 protocol for DSS1.

Brief Description of the Drawings

For a better understanding of the present invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 illustrates schematically a telecommunications network in which user and signalling data is carried between exchanges of the network via an IP network;

Figure 2 illustrates a flow of signalling information in the network of Figure 1; and

Figure 3 is a flow diagram illustrating the transmission of on-hook and off-hook signalling information in the network of Figure 1.

Detailed Description of Certain Embodiments

The following description builds upon the disclosures of the ITU H.323 standard which makes mandatory the use of a DSS1 based standard for establishing and maintaining a call connection between two H.323 enabled nodes. In the example illustrated in Figure 1, two PSTN exchanges 1,2

of a telecommunications network communicate with respective ISUP gateway exchanges 3,4 using the TUP signalling protocol. The ISUP exchanges in turn communicate with respective H.323 gateway nodes 5,6 using the ISUP interface. The gateway nodes 5,6 communicate with one another over a packet switched data network 7 (in this case an IP network). More particularly, the H.323 protocol layer is located above the TCP/IP layers in the protocol stacks of the two gateway nodes 5,6.

The exchanges 1,2 provide PSTN access points to the telecommunications network for respective subscriber terminals 8,9. In the case of a call between the two terminals 8,9, the terminal 8 from which the call is established is referred to as the A-subscriber whilst the other terminal 9 is referred to as the B-subscriber. It will be appreciated that the exchanges 1,2 may be located in the network of a single operator or may be located in networks of different operators. It will also be appreciated that the terminals 8,9 may be connected to respective access exchanges 1,2 via intermediate routing nodes.

In order to allow signalling messages to pass seamlessly between the exchanges 1,2, the H.323 gateway nodes 5,6 make use of an extended version of the DSS1 protocol specified by H.323. More particularly, the DSS1 protocol is extended to enable certain PSTN (and associated ISUP) parameters to be transmitted over the TCP/IP network 7.

The exchange 1 acts as a collector of information relevant to call charging, for a call initiated from the A-subscriber 8. More particularly, the exchange 1 passes information such as call initiation and termination signals, and calling and called party locations, to a Call Charging Point (or Toll Ticketing arrangement) 10 which calculates a toll ticket for a given call on the basis of the information received from the exchange 1 and certain predefined tariff information (including subscriber specific tariff information).

The basic DSS1 standard defines a NOTIFY message having the following structure, where the Reference indicates the corresponding Information element reference in the DSS1 standard, Direction indicates the direction(s) in which an element may be carried by the NOTIFY message (n = network, u = H.323 user), and Length indicates the length of the element in octets:

Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M	2
Message type	4.4	Both	M	1
Bearer capability	4.5	n → u	O	2-12
Notification indicator	4.5	Both	M	3
Display	4.5	n → u	O	≥2

Of the six message elements, the Notification Indicator element is defined in the existing DSS1 standard as having two meaningful values or states. These are:

Bits 7 6 5 4 3 2 1	
0 0 0 0 0 0 0	User suspended
0 0 0 0 0 0 1	User resumed

All other values are currently reserved.

What is proposed here is an extension to the DSS1 protocol to provide a Notification Indicator element able to convey the detection of an off-hook and an on-hook operation at the B-subscriber. These two operations are assigned to any two of the reserved values of the Notification Indicator element.

Consider for example that a call is in progress between the terminals 8,9 and that the B-subscriber 9 terminates the call by hanging-up (B-subscriber Initiated Call Clearing, B-ICC). In order to initiate the call suspension timer, the Call Charging Point 10 must receive a CLB signal. The exchange 2 polls the called party terminal 9 to detect the on-hook operation, and upon detection generates a CLB signal. The exchange 2 passes the CLB signal to the ISUP gateway exchange 4 which generates a corresponding SUSPEND signal which is forwarded to the H.323 gateway node 6. The gateway node 6 generates a NOTIFY message in which the Notification Indicator element has a value corresponding to the CLB signal. The gateway node 6 subsequently transmits the

NOTIFY message over the IP network 7 to the initiating side gateway H.323 node 5. This gateway node 5 generates an ISUP SUSPEND message and passes it to the ISUP gateway exchange 3 which generates a CLB signal which is passed to the PSTN exchange 1. The CLB signal is forwarded to the CCP 10 which initialises the suspension timer in response.

In the event that the B-subscriber "reanswers" his telephone within some predefined time period (e.g. 90 seconds) following the earlier hang-up, this is also detected by the exchange 2 and a call REANSWER message is generated and passed to the ISUP gateway exchange 4. The gateway exchange 4 generates an ISUP RESUME signal and passes it to the H.323 gateway node 6. Again, a NOTIFY message is generated at the gateway node 6, the message including as a Notification Indicator element a value corresponding to a REANSWER message. This is relayed to the originating side H.323 gateway node 5, converted into an ISUP RESUME message and passed to the ISUP gateway exchange 3. A TUP REANSWER message is formed and passed to the PSTN exchange 1. The REANSWER message is passed to the CCP 10 which, in response, terminates the suspension timer so that the call is not subsequently terminated. The suspension and reanswer signalling flow is illustrated in Figure 2.

Figure 3 is a flow chart illustrating the steps involved in the setting up of a call between the two terminals 8,9 and the subsequent termination of the call by the B-subscriber 9.

It will be appreciated by the person of skill in the art that various modifications may be made to the above described embodiment without departing from the scope of the present invention. For example, as an alternative to extending the existing DSS1 protocol, comprehensive interworking between ISUP and H.323 may be achieved by substituting the DSS1 protocol for the Q.763 protocol which is the protocol used by ISUP. Thus, complete interworking is assured.

Claims

1. A method of communicating signalling information between a pair of telecommunication networks employing ISUP or PSTN signalling, via a network, the method comprising using the H.323 protocol to communicate over the said network where signalling data is carried by a DSS1 based protocol extended to provide for the transmission of ISUP/PSTN information which cannot be carried by DSS1.

2. A method according to claim 1, wherein the method is used for initiating a timer procedure at a call charging point of one of the ISUP/PSTN networks, the method comprising the further steps of:

detecting an on-hook state of a called party; and

signalling a timer initiation request from the called party access point to the call charging point by means of an extension to the DSS1 based protocol.

3. A method according to claim 2, wherein a subsequent off-hook state of the called party results in signalling a REANSWER request to the call charging point whereupon the connection is re-established.

4. A method according to claim 2 or 3, wherein the on-hook state is detected at the access point of the called party, and the timer initiation request is signalled by means of the extension of the DSS1 based protocol from the access point of the called party to the call charging point, the call charging point of the calling

party being integrated or linked to the access point of the calling party.

5. A method according to any one of claims 2 to 4, wherein the timer initiation signal is a Clear Back (CLB) signal which causes an immediate initialisation of the call suspension timer which upon expiry will clear the call.

6. A method according to any one of the preceding claims, wherein the DSS1 based protocol is extended to include an extension for signalling a REANSWER or a REANSWER signal (RES) to the charging point of the calling party for cancelling the call suspension timer.

7. A method according to any one of the preceding claims, wherein said data network which uses H.323 is a packet switched data network.

8. A method according to claim 7, wherein said data network is an IP network.

9. A method of passing a Clear Back (CLB) and/or REANSWER message from a PSTN access point to a call charging point via a network which uses a DSS1 based signalling protocol, the method comprising defining call clearback and reanswer parameters and including one or other of the parameters as a Notification Indicator information element of a NOTIFY message of the DSS1 based protocol, for transmission over said network, in response to generation of a Clear Back or REANSWER message at the PSTN access point.

10. A method according to claim 9, wherein the Notification Indicator information element is available for transmission from a called party access point to the charging centre or calling party access point in response to an off-hook operation at the called party, wherein the element conveys an off-hook notification value.

11. A method according to claim 9 or 10, wherein the method comprises polling the called party from the called party access point to detect an on-hook operation.

12. A method according to any one of claims 9 to 11, wherein said DSS1 based signalling protocol is used by an H.323 network to establish and control connections over said network.

13. Apparatus for communicating signalling data between a pair of telecommunication networks employing ISUP or PSTN signalling, via a data network, the apparatus comprising means for using H.323 protocol to communicate over the data network where signalling data is carried by a DSS1 based protocol extended to provide for the transmission of ISUP/PSTN messages which cannot be carried by DSS1.

14. A method of communicating signalling data between a pair of telecommunication networks employing ISUP or PSTN signalling, via a data network, the method comprising using H.323 protocol to communicate over the

data network, wherein signalling data is carried by a Q.76x (ISUP) based protocol substituted in the H.323 protocol for DSS1.

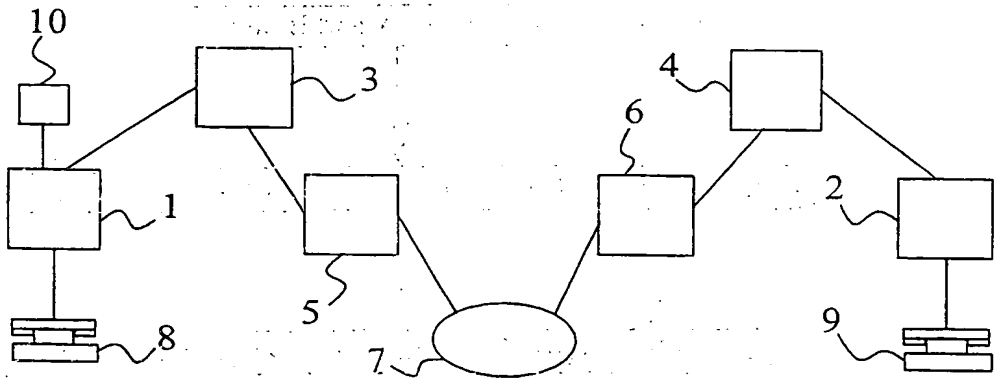

Fig. 1

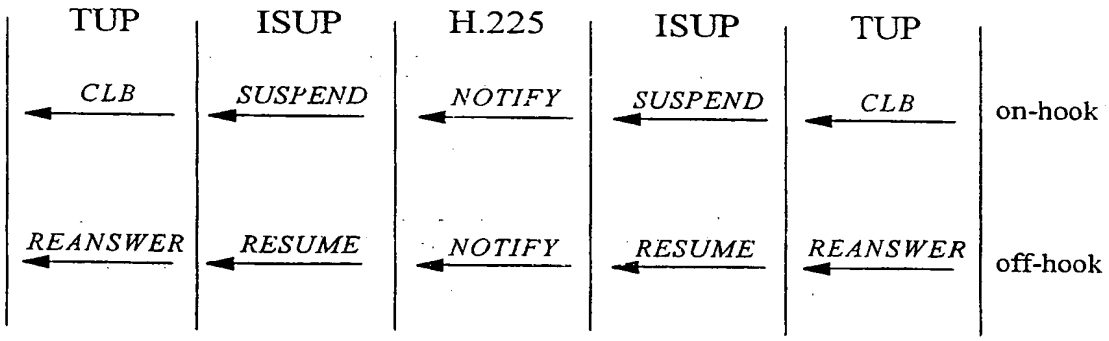

Fig. 3

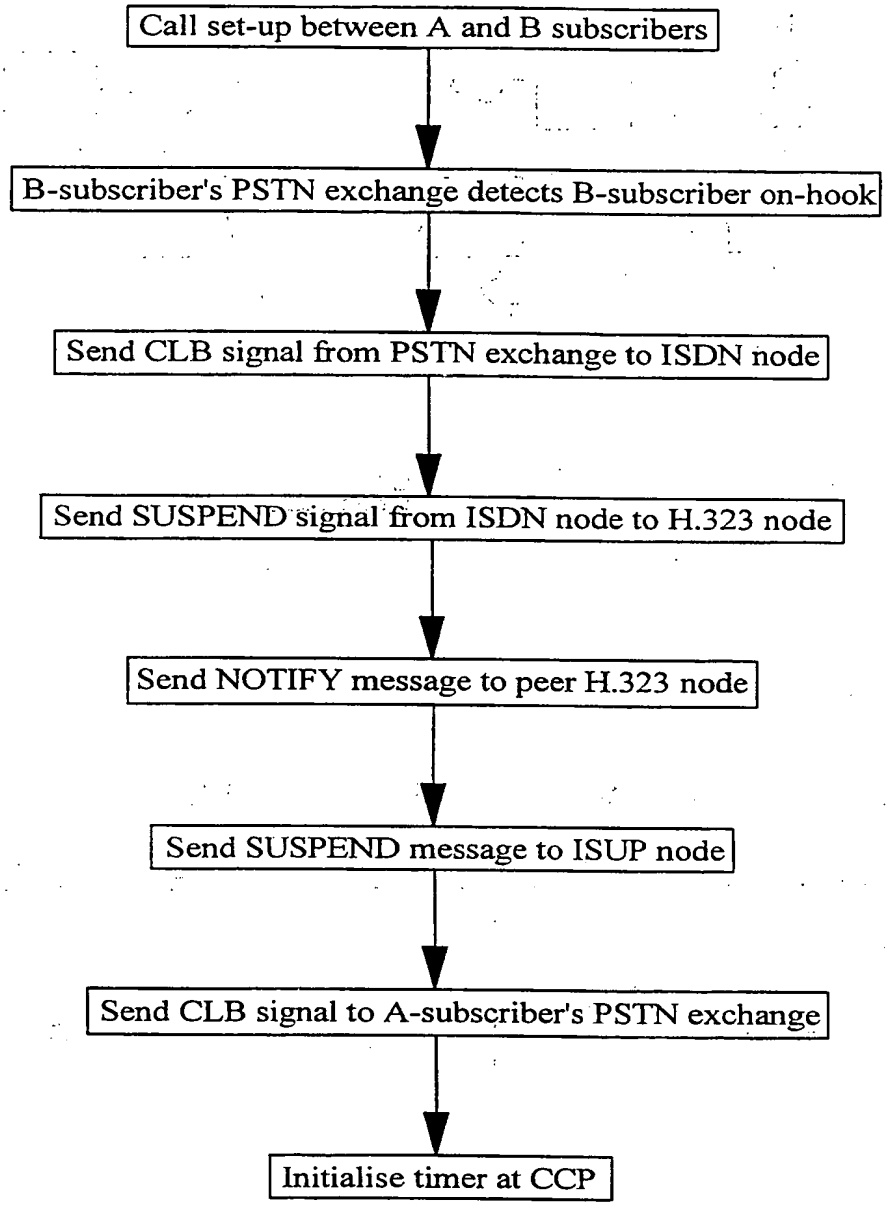

Figure 2

INTERNATIONAL SEARCH REPORT

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PCT/EP 99/06168

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q3/00 H04M7/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 841 831 A (AT & T CORP) 13 May 1998 (1998-05-13) column 3, line 29 -column 4, line 30 column 5, line 50 -column 6, line 37 claims 1-16	1-14
A	US 5 764 750 A (CHAU TOAN ET AL) 9 June 1998 (1998-06-09) column 1, line 36 -column 2, line 48	1-14

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[X] Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 November 1999	01/12/1999

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 99/06168

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	TOGA J ET AL: "ITU-T STANDARDIZATION ACTIVITIES FOR INTERACTIVE MULTIMEDIA COMMUNICATIONS ON PACKET-BASED NETWORKS: H.323 AND RELATED RECOMMENDATIONS" COMPUTER NETWORKS AND ISDN SYSTEMS,NL,NORTH HOLLAND PUBLISHING. AMSTERDAM, vol. 31, no. 3, page 205-223 XP000700319 ISSN: 0169-7552 the whole document	1-14
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